

4G/5G Wireless Telecommunications Expansion: Public Health and Environmental Implications

by Dr. Cindy L. Russell | <https://www.sciencedirect.com/science/article/pii/S0013935118300161>

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I am highlighting the excellent paper, above, and am encouraging everyone to read it. I have written the following building on the ideas introduced in the paper's abstract and conclusions. I added a section on Biologically-Based Electromagnetic Fields and Radio-frequency Electromagnetic Microwave Radiation Exposure Guidelines

[Abstract](#) | [EMF/RF-EMR Exposure Guidelines](#) | [Conclusions](#)

Adapted from the paper's abstract

The popularity, widespread use and increasing dependency on wireless broadband technologies has spawned a telecommunications revolution with increasing public exposure to pulsed, data-modulated, **Radiofrequency Electromagnetic Microwave Radiation (RF-EMR)** at more and higher frequencies (and broader bandwidth on those frequencies) for longer periods of time — **approaching constant exposures — 24/7**. Using the public's electromagnetic spectrum, private Telecom companies are being allowed to build a massive infrastructure in our public rights-of-way — a network of powerful antennas, radios and power supplies that will invade our neighborhoods and public spaces, and continually burn through terawatts of electricity — in order to **unnecessarily spray large data-payloads, such as HD/4k videos, through-the-air from infrastructure antennas to a variety of devices** and back again.

This is unnecessary because sending HD/4k videos (and Internet data) is accomplished much more directly, securely, reliably and energy-efficiently by installing [fiber optic cables to the premises \(FTTP\)](#) — an upgrade for which [Californians already paid \\$16 Billion](#) to our State Telecom Public Utility (AT&T California), which **took the billions of dollars, but never completed the job. Instead, AT&T Corporate fraudulently transferred the balance of these public funds to its separate, private subsidiary, AT&T Mobility, to build out its 4G/LTE Wireless network.** No surprise, Verizon did the same in New York; Verizon was investigated and sued over this fraud — leading to a [multi-billion dollar settlement in New York](#).

The FCC and the CPUC are of no help here because they are both [captured agencies](#) — they are both dominated by the industries that they presumably regulate, and operate more like branches of the Telecom companies than agencies that protect the public good.

Read: <http://mystreetmychoice.com/press.html> | <http://mystreetmychoice.com/press.html#kushnick>
<http://scientists4wiredtech.com/2018/04/new-networks-institute-files-to-halt-proposed-verizon-ny-settlement/>
http://ethics.harvard.edu/files/center-for-ethics/files/capturedagency_alster.pdf

What's Coming Next

On the horizon, a new generation of even higher frequencies (24,000–90,000 MHz), with shorter wavelengths (ranging from around 100 millimeters down to 1 mm) are being added to the current 2G/3G/4G frequencies (700–2100 MHz) and corresponding wavelengths (ranging from 17" down to 6") to offer a panoply of frequencies/wavelengths that will **aggregate enough bandwidth to power wireless video subscriptions** and, eventually, the Internet of Things (IoT).

The Panoply of Microwave Frequencies/Wavelengths in a 4G/5G World

From <http://scientists4wiredtech.com/microwave-primer/>

- **5G:** 600 MHz = waves 20 inches long
- 4G: 700 MHz = waves 17 inches long
- 3G/4G: 800 MHz = waves 15 inches long
- 3G/4G: 900 MHz = waves 13 inches long
- 3G/4G: 1800 MHz = waves 7 inches long
- 3G/4G: 2100 MHz = waves 6 inches long
- Wi-Fi: 2450 MHz = waves 5 inches long (unlicensed)
- **5G:** 3100 MHz to 3550 MHz = waves 3.8 to 3.3 inches long
- **5G:** 3550 MHz to 3700 MHz = waves 3.3 to 3.2 inches long
- **5G:** 3700 MHz to 4200 MHz = waves 3.2 to 2.8 inches long
- **5G:** 4200 to 4900 MHz = waves 2.8 to 2.4 inches long
- Wi-Fi: 5800 MHz = waves 2.0 inches long (unlicensed)
- **5G:** 24,250 to 24,450 MHz = waves 0.5 inch long
- **5G:** 25,050 to 25,250 MHz = waves 0.5 inch long
- **5G:** 25,250 to 27,500 MHz = waves 0.4 inch long
- **5G:** 27,500 to 29,500 MHz = waves 0.4 inch long
- **5G:** 31,800 to 33,400 MHz = waves 0.4 inch long
- **5G:** 37,000 to 40,000 MHz = waves 0.3 inch long
- **5G:** 42,000 to 42,500 MHz = waves 0.3 inch long
- **5G:** 57,000 to 64,500 MHz = waves 0.3 inch long (unlicensed)
- **5G:** 64,000 to 71,000 MHz = waves 0.2 inch long
- **5G:** 71,000 to 76,000 MHz = waves 0.2 inch long
- **5G:** 81,000 to 86,000 MHz = waves 0.1 inch long

In 2018, we are living in a field of propaganda and distortion about the supposed benefits of the 4G/5G densification being pushed on local communities by the US Congress, the FCC, uninformed State Legislatures and Public Utility Commissions — all heavily-influenced by the Telecom company lobbyists' [hundreds of millions of dollars "invested" in our public officials to curry these favors](#). These so-called leaders, however, are **not considering the downsides** of such an unnecessary and massive 4G/5G Wireless densification because even these higher frequencies (24,000–90,000 MHz) have been shown to **transmit data out 3,000 feet or farther**:

View: **No Cell Antennas Needed in Residential Areas** (<https://youtu.be/FwAsr1pC13Q>)



Lowell McAdam, CEO of Verizon:

"When [Verizon] went out in these 11 [5G test] markets, we tested for well over a year, so we could see every part of foliage and every storm that went through. We have now busted the myth that [5G frequencies] have to be line-of-sight — they do not. We busted the myth that foliage will shut [5G] down . . . that does not happen. And the 200 feet from a home? **We are now designing the network for over 2,000 feet from transmitter to receiver**, which has a huge impact on our capital need going forward. Those myths have disappeared."

Jason L., Verizon Field Engineer:

"[Verizon 5G] is really high frequency [28,000 MHz and 39,000 MHz], so everybody thinks it doesn't go very far, but it's a really big pipe and so that's what allows you to gain the super-fast speeds . . . We're 3,000 feet away from our radio node. the cool thing about this is that we did not move the radio node. It's pointing down to serve the customers in that area " . . . here **even 3,000 feet away, we're still getting 1,000 [Megabits per second] speeds** . . . So now we've driven about 1/3 of a mile away [1,760 feet] from the radio node. we are still getting very good speeds even though we have foliage in between [800 Megabits per second]."

Downsides of The Misguided "Ready-Fire-Aim!" 4G/5G Densification Scheme

- Wirelessly spraying video and internet data is incredibly energy-inefficient. Listen to this 6/12/18 public comment, which starts at 3:09:56 in the first video on this page: <http://mystreetmychoice.com/petaluma.html>
- Fiber Optic broadband is far superior to Wireless broadband. Fiber to the Premises (FTTP) is much safer, more secure, more reliable and energy-efficient than Wireless.
- Equipped with Fiber-to-the home, people can make emergency calls by both wired means (with corded phones using Voice over Internet Protocol – VoIP) or wireless means (using Wi-Fi calling). There is no need for in-building coverage from Wireless Carriers to handle these emergency calls; these calls can be safely connected via fiber optic or copper wirelines. So-called "in-building" coverage is **not the standard** for judging a Significant Gap in Coverage. See: <https://caselaw.findlaw.com/us-9th-circuit/1406360.html>
- Health and safety hazards from 24/7/365 exposures to multi-frequency, multi-axial pulsed, data-modulated, Radio-frequency Electromagnetic Microwave Radiation (RF-EMR) remain unaddressed. The best protection is to ensure that RF-EMR exposures do not exceed levels known to cause biological effects: **limit RF-EMR exposures** to signal strengths from any single frequency to be **no higher than -75 dBm** and **limit total power flux density** (from all RF-EMR frequencies) **no higher than 100 $\mu\text{W}/\text{m}^2$**

- . . .while the Wireless industry and our "**overly-influenced**" elected representatives insist on keeping the "pedal to the metal" — without looking at the significant, convincing data that already show significant harm from exposures to current Wireless 2G, 3G and 4G frequencies/wavelengths. The coming 5G millimeter-wave frequencies are less studied for human or environmental effects, but also show harm.
- Despite the **largely empty promises** that the IoT and massive 4G/5G densified telecommunications network will give us convenient and easy lifestyles, it is argued that the addition of this **millimeter-wave (mm-wave) 5G RF microwave radiation added to an already complex mix of 2G/3G/4G RF microwave radiation, will contribute to a negative public health outcome both for both our physical and mental health.**

<http://scientists4wiredtech.com/legislation/100-million-to-us-congress-from-big-telecom-and-cable/>

Pulsed, data-modulated, Radio-frequency Electromagnetic Microwave Radiation (RF-EMR) is increasingly being recognized as a new form of **environmental pollution**. Like other common toxic exposures, the effects of RF-EMR will be problematic if not impossible to sort out epidemiologically as there no longer remains an unexposed control group. This is especially important considering that these adverse effects are likely magnified by exposures to other toxic agents — acting synergistically. Importantly, adverse health effects can be non-linear because the the data show that living systems have biological windows, meaning that effects can increase exponentially with exposures to power levels within a narrow window (Adey, 1994 ¹).

Since we are observing the first generation with a cradle-to-grave lifespan exposure to this level of man-made RF-EMR Electrosmog, it will be years or possibly decades before the true magnitude of health consequences are fully known, but much evidence of harm exists today. This makes the current push for 4G/5G and Wi-Fi densification in our residential neighborhoods, schools and public spaces imprudent and, very likely, hazardous.

This paper reviews relevant literature on the effects of RF-EMR exposures and the inadequacy of current national RF-EMR exposure guidelines. I will review current scientific literature on the health implications of exposures from 2G, 3G, 4G pulsed, data-modulated, Radiofrequency Electromagnetic Microwave Radiation (RF-EMR) , as well as some of available literature on exposures to 5G mm-wave frequencies. The question of what constitutes a public health issue will be raised, as well as the need for a more intelligent approach when advancing new Wireless technologies.

<https://www.sciencedirect.com/science/article/pii/S0013935118300161>

Biologically-Based Electromagnetic Fields and Radio-frequency Electromagnetic Microwave Radiation Exposure Guidelines

BioInitiative, 2017: "A scientific benchmark of 30 $\mu\text{W}/\text{m}^2$ for lowest observed effect level for RF microwave radiation is based on mobile phone base station-level studies. Applying a ten-fold reduction to compensate for the lack of long-term exposure (to provide a safety buffer for chronic exposure) or for children as a sensitive subpopulation yields a **3 to 6 $\mu\text{W}/\text{m}^2$** RF Microwave Radiation exposure guideline"

<http://www.bioinitiative.org/updated-research-summaries-december-2017/>

Similar scientifically-based Electromagnetic Fields and Radio-frequency Electromagnetic Microwave Radiation

Exposure Guidelines are published by the [International Institute for Building-Biology & Ecology](http://www.createhealthyhomes.com/richtwerte-2015-englisch.pdf):

ANOMALY →	No	Slight	Severe	Extreme	FCC Guideline
RF Microwave Radiation ($\mu\text{W}/\text{m}^2$)	< 0.1	0.1–10	10–1,000	1,000	10,000,000
Magnetic Fields (mG)	< 0.2	0.2–1	1–5	> 5	N/A
Electric Fields (V/m)	< 1	1–5	5–50	50	N/A

<http://www.createhealthyhomes.com/richtwerte-2015-englisch.pdf>

Terms/Units defined:

1. **Anomaly**: something different, abnormal, peculiar
Example: *Her C grade is an anomaly because she's never earned anything but A's and B's before.*
2. $\mu\text{W}/\text{m}^2$ = microWatts or millionths of a Watt per square meter, which is a power flux density — the amount of electrical power that flows through a defined two-dimensional area
3. **mG** = milliGauss or thousandths of a **Gauss**, which is a magnetic flux density — the amount of magnetic power that flows through a defined two-dimensional area. One Gauss is one **Maxwell** per square centimeter)
4. **V/m** = Volts per meter, potential difference of one **Volt** existing between two points that are one meter apart.
5. **FCC Guideline** = 10,000 $\mu\text{W}/\text{m}^2$ for frequencies from 1,500 MHz to 300,000 MHz. Below 1,500 MHz, calculate (frequency/1,500) × 10,000,000. For example, the FCC guideline for 600 MHz is 4,000,000 $\mu\text{W}/\text{m}^2$ and for 900 MHz it is 6,000,000 $\mu\text{W}/\text{m}^2$. There is more information at <http://scientists4wiredtech.com/regulation/rf-microwave-exposure-guidelines/>

Discussion

- **One cannot miss** the many orders-of-magnitude difference between these two numbers:
 - **10 $\mu\text{W}/\text{m}^2$** : an RF-EMR exposure level that can be biologically tolerated.
 - **10,000,000 $\mu\text{W}/\text{m}^2$** : an outdated, scientifically unsound, **commercial guideline** adopted by the FCC that serves only the Wireless industry's business goals.
 - **Independent Scientific data** (research that is not funded the Wireless industry) show that **RF-EMR exposures even 100,000 times lower than the FCC RF-EMR exposure guideline** does not protect humans, animals, insects or plants from adverse biological effects.
 - **0.02 $\mu\text{W}/\text{m}^2$** : (which corresponds to -75dBm) is all that is needed for "five bars" signal strength on a cell phone, according to Wireless industry **drive tests**. This is explained in more detail here: <http://mystreetmychoice.com/press.html#guidelines>
- **Power Flux Density (PFD)** measures only the **rate of electrical power**. PFD does **NOT** measure the total electrical power delivered over time, which would require the rate to be multiplied by the time of exposure, reported in a more relevant unit: **$\mu\text{W-seconds}/\text{m}^2$** or **$\mu\text{Joules}/\text{m}^2$** .
 1. **Note**: you encounter a very similar unit whenever you pay your electric utility bill: you pay for **kilowatt-hours** of electrical power (the total power used), **not just kilowatts** (the rate at which the power was delivered).
 2. **The importance of total exposure over time is self-evident to each of us** with another form of electromagnetic radiation: exposures from the Sun. You can walk outside naked at mid-day on a sunny day and you will get a mild "sun tan", but if you stake yourself on the ground naked for five consecutive days, you will experience

severe sun burn, skin damage and possibly the start of skin cancers. It is crystal clear that **time of exposure matters** for all forms of electromagnetic radiation, whether that is exposures from the sun or exposures from pulsed, data-modulated, Radio-frequency Electromagnetic Microwave Radiation.

3. **This is very similar to the problem of 24/7/365 RF-EMR exposures** from Close Proximity Microwave Radiation Antenna – Wireless Telecommunications Facilities (CPMRA-WTFs) installed in communities very close to where people, live, work, play, sleep and heal. Living systems cannot biologically tolerate 24/7/365 RF-EMR exposures.
 4. **Conclusion:** We need be some areas **without high levels of 24/7/365 RF-EMR exposures** in our communities: residential zones, schools, parks and facilities used for child care, elder care, fire, police, and medical services.
- **Average $\mu\text{W}/\text{m}^2$ readings**, as specified by the FCC, **significantly under-report** the levels of pulsed, data-modulated, RF microwave radiation exposures for two reasons —
 1. **Peak** RF microwave radiation exposures meter **100x–1000x higher than average** RF microwave radiation for data-carrying, modulated, high-crest signals like Wi-Fi, 4G/LTE and 5G because of the duty cycle, inherent in these RF signals. Inexplicably, the FCC RF microwave radiation exposure guidelines only consider average RF microwave radiation exposures, which is a significant error because living organisms' biology reacts to the sharp changes of RF microwave radiation from zero to peak levels and back again. This is more fully explained here: [Palo Alto Whitewashes RF Microwave Radiation Exposure Hazards](http://scientists4wiredtech.com/2017/12/broadband-fail-palo-alto-1/).
<http://scientists4wiredtech.com/2017/12/broadband-fail-palo-alto-1/>
 2. The FCC RF microwave radiation exposure guidelines consider neither the time of exposure nor the total electrical power delivered over time, which is **utter nonsense and scientifically unsound**. This is more fully explained here: <http://electrosensei.com/counter.html#counter>.

Adapted from the paper's conclusions

Although the proposed 4G/5G densification promises many uses and benefits — imagined and unimagined — it is increasingly **clear that significant negative consequences to human health and ecosystems could occur if it is widely adopted**. Current pulsed, data-modulated, Radio-frequency Electromagnetic Microwave Radiation (RF-EMR) frequencies/wavelengths. to which we are exposed, **already act as a toxin to biological systems**.

A moratorium on the deployment of 4G/5G densification is warranted, along with development of **independent** health and environmental advisory boards that include independent scientists who research the biological effects of RF-EMR exposures and **significantly reduce the national guidelines for RF-EMR exposure levels**. Sound regulatory policy regarding current and future telecommunications initiatives will require more careful assessment of risks and hazards to human health, environmental health, public safety, privacy, security and social consequences. **Public health regulations need to be updated to match the findings of independent science and adopt biologically-based exposure standards — prior to further deployment of 4G or 5G densification**.

Considering the findings from current science, the lack of relevant exposure standards based

on known biological effects and the data gaps in research, we need to significantly reduce the population's exposure to RF-EMR from all manmade sources. Laws or policies which restrict the full integrity of science and the scientific community with regards to health and environmental effects of Wireless technologies or other toxic exposures should be changed to **enable unbiased, objective science to drive necessary public policies and regulation.**

Climate change, fracking, toxic emissions and RF-EMR exposures from wireless devices all have something in common with smoking. There has been much denial and confusion about health and environmental hazards, along with industry's insistence for absolute proof before regulatory action occurs (Frentzel-Beyme, 1994 ², Michaels, 2008 ³).

There are many lessons we have must learn about the introduction of novel substances, which later became toxic environmental pollutants because we have not heeded warning signs from scientists (Gee, 2009 ⁴). The threats of these common pollutants continue to weigh heavily on the health and well-being of our nation. Currently, we seem to accept these hazards as the price of progress. **If we continue to ignore the findings of independent scientists and wait for unquestioned proof of harm, will it be too late at that point for some or all of us?**

Footnotes